



Role of Sniffer Bee

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The common bee has become an unexpected ally in the field of biosensing technologies, where accuracy and sensitivity are critical. Not only are bees skilled at pollination, but scientists have also discovered that they have an amazing capacity to detect a broad range of compounds, from illnesses to explosives. Often referred to as "sniffer bees," this novel use of bees in biosensing provides an intriguing nexus of biology and technology, with the potential to yield substantial advances in a number of sectors.

The Olfactory Expertise of Bees

Bees have an amazing sense of smell, especially honeybees and bumblebees. They are excellent candidates for biosensing applications because their olfactory receptors are precisely calibrated to detect minuscule amounts of scents. Their antennae, which contain thousands of odor sensors with the extraordinary ability to discriminate between intricate blends of volatile organic compounds (VOCs), are the source of their sensitivity.

Training Bees as Biosensors

Bees are trained to function as biosensors by a mix of positive reward and classical conditioning. Scientists subject bees to certain scents linked to target materials, including diseases or explosives. A bee is rewarded, usually with sweet water, for correctly identifying the target odor. Bees become skilled at identifying the target odor in a variety of settings by repeatedly teaching them to link it with the reward.

Applications in Security and Agriculture

Sniffer bees are widely used in defense and security applications. Bees are a portable and effective substitute for conventional detection techniques since they have been trained to identify explosives like TNT and C4 with great accuracy. They are useful tools for finding concealed bombs in a variety of environments because of their quickness in covering wide regions.

In agriculture, sniffer bees hold promise for pest and disease management. They can detect diseases such as American foulbrood in beehives, aiding beekeepers in early intervention to prevent colony losses. Additionally, researchers are exploring the use of bees to detect crop diseases and pest infestations by recognizing specific volatile compounds emitted by plants under stress.

Advantages Over Traditional Sensors

Sniffer bees offer several advantages over conventional electronic sensors. They are highly sensitive, capable of detecting substances in concentrations as low as parts per trillion.

Moreover, bees are adaptable to different environmental conditions and can operate in remote or challenging terrains where electronic devices may be impractical or unreliable.

Future Directions and Challenges

While the potential of sniffer bees in biosensing technology is vast, there are challenges to overcome. Training consistency, environmental factors influencing bee behavior, and scalability of bee-based biosensors are areas of ongoing research. Advances in understanding bee physiology and behavior, coupled with innovative training techniques, will be crucial in optimizing their performance and expanding their applications.

Conclusion

Sniffer bees represent a remarkable example of nature-inspired technology, harnessing the innate abilities of bees for practical applications in biosensing. From enhancing security measures to revolutionizing agricultural practices, these bio-inspired sensors hold promise for diverse fields. As research continues to unfold, the integration of sniffer bees into biosensing technology stands poised to make significant contributions to safety, sustainability, and innovation in the modern world. In summary, while bees continue their vital role in pollination, their newfound role as biosensors underscores their versatility and the boundless potential of bioinspired technologies in addressing complex challenges.

References

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